STAFF REPORT

PESTICIDE USE ON FALL POTATOES IN THE NORTHEAST REGION, 1979

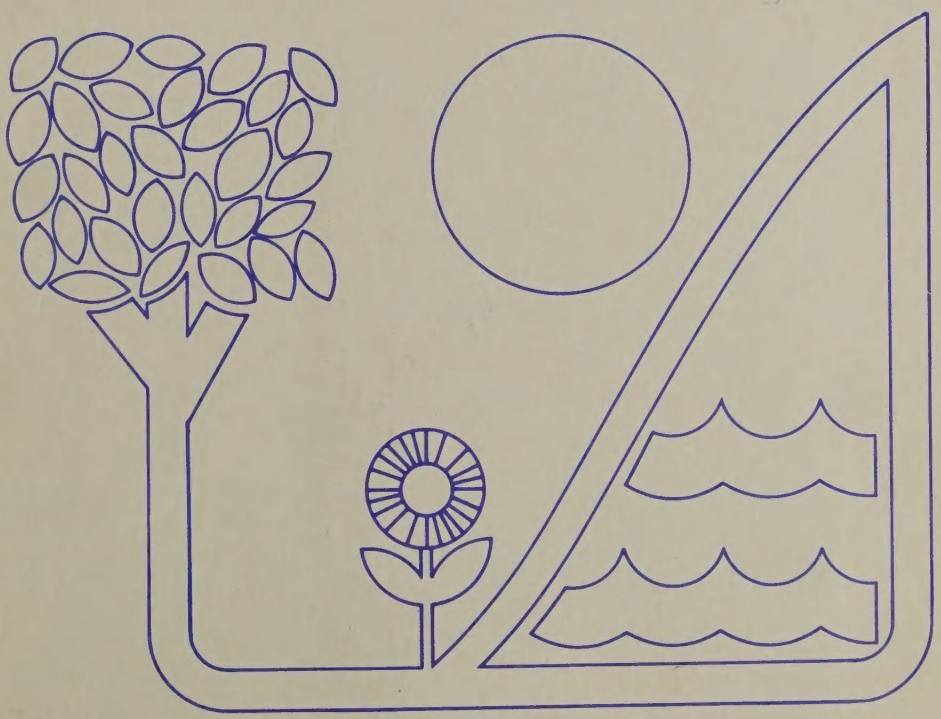
by

John R. Parks

May, 1982

NRE Economic Research Service

United States Department of Agriculture



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PESTICIDE USE ON FALL POTATOES IN THE NORTHEAST REGION, 1979. By John R. Parks; Natural Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250; May 1982.

ERS Staff Report No. AGES820518

ABSTRACT

A survey of pesticides used in fall potato production was conducted by the U.S. Department of Agriculture in 1979. Information is reported for Maine, New York, and Pennsylvania. An estimated 3.5 million pounds (active ingredient) of pesticides were used. Of the 188,500 acres planted to potatoes in the Northeast region, at least 96 percent were treated with a herbicide, fungicide, and/or insecticide. Almost 2.5 million acre-treatments of pesticides were made in 1979, averaging 1.4 pounds (a.i.) per acre-treatment. Coefficients of variation were calculated for acres treated with specific pesticides.

Key words: Pesticides, potatoes (fall), herbicides, fungicides, insecticides, vine killers, growth regulators, Northeast region.

ACKNOWLEDGMENTS

Many growers, enumerators, data processors, and others have contributed to this report. Larry Roberson, Survey Division, Statistical Reporting Service, USDA, is acknowledged for his helpfulness. The author is particularly indebted to Hugh Murphy, University of Maine, and Jerry L. Heath, Cornell University, for illuminating biological, ecological, and physiological insights that help us to understand relationships reflected in the survey data. A special thank you to the following who either reviewed the data or provided helpful comments: John B. Dimond, Terry Jones, and Richard H. Storch, University of Maine; Edward D. Jones, Peter L. Minotti, Arthur A. Muka, and Ward M. Tingey, Cornell University; and Richard H. Cole, Stanley G. Gesell, Winand K. Hock, and David R. MacKenzie, Pennsylvania State University. Kenneth M. Koester, Jr., Data Service Center, Economic Research Service, USDA, has been most helpful, timely, and cooperative in data management. Thank you to Andrea Lunsford for preparing drafts and formatting.

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PESTICIDE USE ON FALL POTATOES IN THE NORTHEAST REGION, 1979

INTRODUCTION

This report presents the kinds and amounts of pesticides used on fall potatoes grown in the Northeast region (Maine, New York, and Pennsylvania) (Figure 1). Information is reported on treated acres, acre-treatments, quantities of pesticides applied, and application rates.

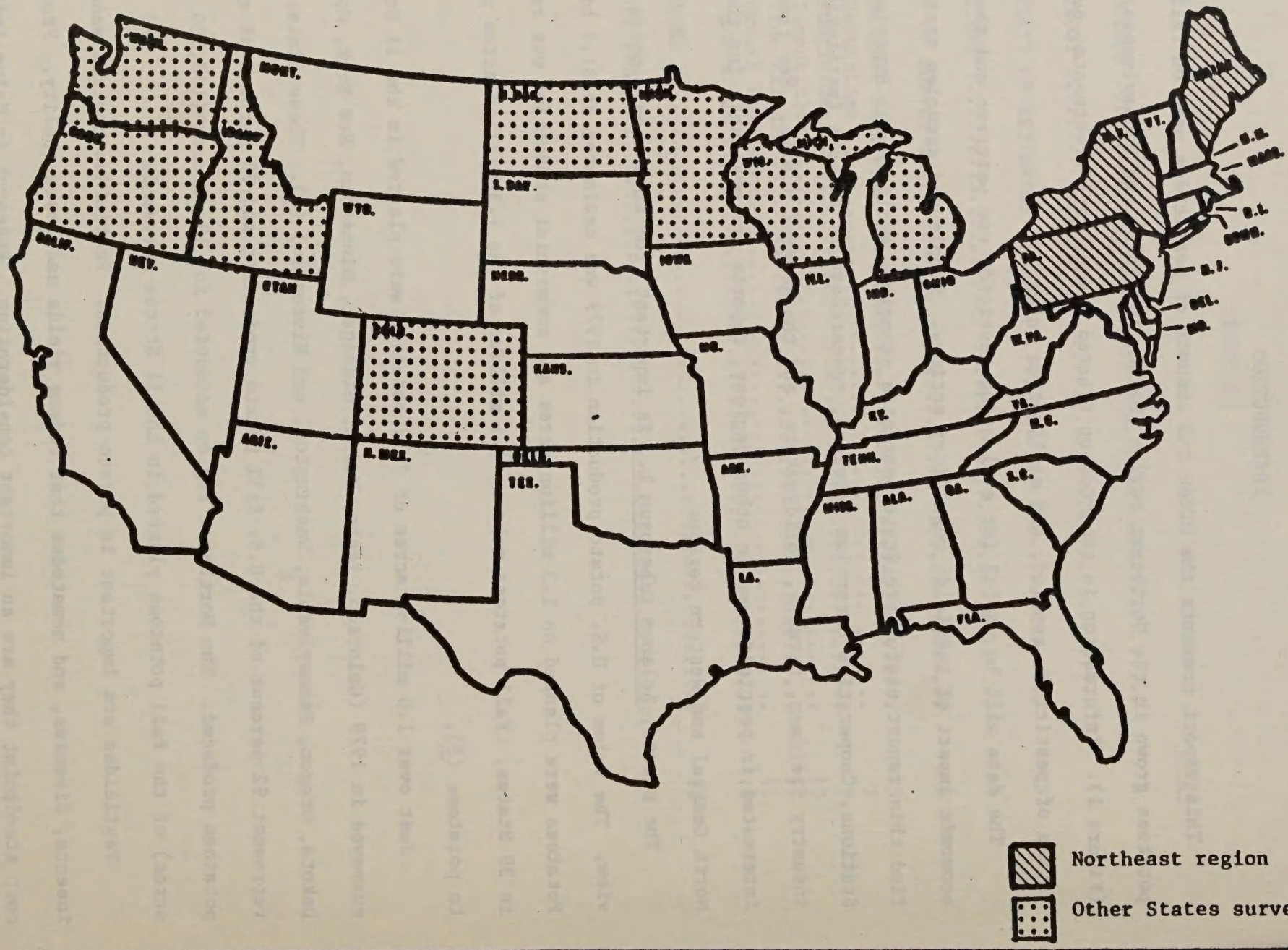
The data will be useful for evaluating pesticide use patterns and the economic impact of pesticide regulatory actions. People and agencies that will find this report useful are State pesticide agencies, Agricultural Experiment Stations, Cooperative Extension Services, researchers in private institutions, industry fieldmen, farmers, policymakers, and the general public. For those interested in pesticide use in other regions, reports are available for the North Central and Western regions.

The potato, Solanum tuberosum L., is important from an economic point of view. The value of U.S. potato production in 1979 was estimated at $1.2 billion. Potatoes were planted on 1.3 million acres and commercial production was reported in 39 States. Fall potatoes make up 1.1 million of the 1.3 million acres planted to potatoes (8).

Just over 1.0 million acres of fall potatoes were planted in the 11 States surveyed in 1979 (Colorado, Idaho, Maine, Michigan, Minnesota, New York, North Dakota, Oregon, Pennsylvania, Washington, and Wisconsin) (8). These States represent 92 percent of the U.S. fall potato production and 80 percent of all potatoes produced. The Northeast region accounted for 19 percent (188,500 acres) of the fall potatoes planted in the 11 States surveyed.

Pesticides are important in potato production. Pesticides control weeds, insects, diseases, and nematodes that reduce yields and lower quality. From a cost standpoint they are an important consideration. Research in Maine indicates that pesticide material costs on tablestock and seed potatoes are about 20 per-

Figure 1. States included in the 1979 Fall Potato Pesticide Survey.



cent of total variable costs (2).

METHODOLOGY

Data in this report were collected in conjunction with the 1979 Potato Objective Yield Survey conducted by the Economics, Statistics, and Cooperatives Service of the U.S. Department of Agriculture. Enumerators from the State Statistical Offices (SSO's) collected the pesticide data through personal interviews.

The sample design was a two-stage multiple frame sample. Sample fields were selected from a list of known growers (list frame) maintained by the SSO's. In addition, area tracts (area frame) were selected to insure that all growers had an opportunity to be included in the sample. Sample fields were randomly selected, and the probability of being selected was proportional to field size. The expansion factor for the State was derived by dividing the planted acres by the completed questionnaires. Out of 490 sample questionnaires 393 were completed.

State	No. of samples	Questionnaires completed
Maine	210	181
New York	170	130
Pennsylvania	110	82
Total	490	393

RELIABILITY OF ESTIMATES

Estimates based on surveys have varying degrees of statistical reliability. Confidence in data depends on sample size, sampling methods, and the variability of responses. To provide some indication of the reliability of the estimates,

coefficients of variation (CV's) are presented in Appendix Tables 1 and 2. The CV is a measure of the relative variation (expressed in percentage terms), and can be used to indicate the degree of confidence a user can place in the estimate. The smaller the CV, the more reliable the estimate.

In simplest terms, it can be said there is a 95 percent confidence that the sample represents the true population and that the true value for the population lies within an interval defined as $\pm$ 2 CV's times the estimated value. For example, with a CV of 10 percent and an estimate of 40, the interval would be 32 to 48. However, there is also a 5 percent chance that the true value does not fall within the interval as defined above because the sample is not representative of the population.

CV's were calculated only for acres treated with specific pesticides. The estimates of acres treated are expected to have greater variation than other data reported. Consequently, for most other information included in this report, the level of reliability should be equal to or greater than reported for acres treated.

DEFINITIONS

For a clearer understanding of the data, a number of terms are defined as follows:

Active ingredient - Pesticide quantities are expressed in terms of active ingredients (a.i.). This is the chemical substance that controls the pest. Inert ingredients such as talc, clay, or solvents used as carriers are not included in the quantity estimates.

Times applied - The number of times a land area was treated with a specific pesticide.

Treated acres - The land area treated with a specific pesticide one or more times. Acres treated with different pesticides cannot be summed because a given land area may have been treated with more than one pesticide.

Acre-treatment - The acres treated with a specific pesticide times the number of applications. Since acre-treatments account for both the area and number of applications, acre-treatments with different pesticides can be summed without double counting.

Tank-mix - Two or more pesticides mixed in the spray tank and applied in a single application.

RESULTS OF SURVEY

General Pesticide Use

In the Northeast region, no one pesticide category was dominant. Herbicides, fungicides, and insecticides were used on 96, 97, and 96 percent, respectively, of the 188,500 acres planted to fall potatoes (Table 1).

Growth regulators, applied in the field to control sprouting in storage, were not widely used; they were used on 4 percent of the planted acreage. This does not account for all growth regulators since products such as chlorpropham (CIPC) and tecnazene, used in storage facilities to control sprouting, were not a part of the survey. Also excluded are products used for seed treatment, facilities, and equipment.

Potato growers, in the Northeast region, made 2.5 million acre-treatments, applying 3.5 million pounds (a.i.) of pesticides in the production of fall potatoes during 1979 (Table 2).

Growers made more acre-treatments to control diseases than for any other pest problem (Table 2). Fungicide treatments accounted for 54 percent of the total pesticide acre-treatments, and 48 percent of the total quantity of all pesticides used. Fungicides were applied from 2.5 to 7.5 times per acre treated.

Table 1. Fall potato acreage and proportion of planted acres treated with pesticides in the Northeast region, 1979 a/

State	Acres planted	Proportion treated with: Herbicides	Fungicides	Insecticides	Vine killers	Growth regulators
	1,000	Percent				
Maine	116.0	97	97	95	85	3
New York	47.5	95	97	97	81	3
Pennsylvania	25.0	95	96	97	59	12
Total	188.5	96	97	96	81	4

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

Table 2. Summary of pesticide use on fall potatoes in the Northeast region, 1979 a/

Pesticides	Acre-treatments	Quantity applied (a.i.): Total	Per acre treatment	Percent of total	Times applied: Range
	1,000	1,000 lbs.	Lbs.		No.
Single applications					
Herbicides	205.7	325.8	1.6	9	1.0-1.2
Fungicides	1,357.9	1,692.5	1.2	48	2.5-7.5
Insecticides	549.7	602.6	1.1	17	1.0-3.5
Vine killers	215.0	560.8	2.6	16	1.0-1.4
Growth regulators	7.7	23.4	3.0	1	1.0
Tank-mixes	155.8	331.1	2.1	9	-
Total	2,491.8	3,536.2	1.4	100	-

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

Herbicides were applied about once and insecticides 1.0 to 3.5 times.

Herbicides

Growers in the Northeast region made 200,000 acre-treatments, using 325,000 pounds (a.i.) of herbicides (Table 3). Metribuzin was the most commonly used herbicide accounting for almost 40 percent of all herbicide acre-treatments. However, in terms of pounds (a.i.) applied, it accounted for only 14 percent of the total quantity of herbicides because it was used at the lowest rate of any herbicide reported, 0.6 pound (a.i.) per acre. Metribuzin was the most commonly used herbicide in each of the three States sampled (Table 3). Metribuzin is a highly effective pre- and postemergent herbicide that controls most common broadleaf weeds such as velvetleaf, ragweed, and barnyardgrass (5, 7).

Linuron and dinoseb were the second and third most commonly used herbicide in the Northeast region. Their acre-treatments were just over 20 percent each of the total herbicide acre-treatments. Each of the States surveyed in the region reported using them. Linuron and dinoseb are used to control annual broadleaf and annual grasses, including barnyardgrass. They may be used pre- or postemergent on potatoes.

Fungicides

More fungicides were used on potatoes than any other category of pesticides. Almost 1.4 million acre-treatments were made and 1.7 million pounds (a.i.) applied. Disease control is the most pressing problem in the Northeast potato growing region (Table 4). Maneb/mancozeb made up 74 percent of all fungicide acre-treatments. Maneb and mancozeb are very similar products, with similar modes of action. In this report their data were combined and treated as a single entry. Chlorothalonil and captafol were the second and third most commonly used fungicides in New York and Pennsylvania. Chlorothalonil and captafol were used to control

Table 3. Herbicide use on fall potatoes in the Northeast region, 1979 a/

State and herbicide	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Per acre Treated	Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Maine						
Dalapon	4.1	4.1	23.1	5.6	5.6	1.0
Dinoseb	30.3	30.3	59.5	2.0	2.0	1.0
Linuron	30.4	30.4	19.4	.6	.6	1.0
Metribuzin	44.1	44.1	21.5	.5	.5	1.0
Other	-	1.8	5.8	-	3.2	-
Total	-	110.7	129.3	-	1.2	-
New York						
Chlorbromuron	1.8	2.2	3.7	2.1	1.7	1.2
Dalapon	.4	.4	3.4	8.5	8.5	1.0
Dinoseb	9.7	11.0	28.1	2.9	2.6	1.1
EPTC	13.8	13.8	63.6	4.6	4.6	1.0
Linuron	16.0	16.0	18.0	1.1	1.1	1.0
Metribuzin	12.7	16.7	12.4	1.0	.7	1.3
Other	-	2.9	3.8	-	1.3	-
Total	-	63.0	133.0	-	2.1	-
Pennsylvania						
Dalapon	1.8	1.8	9.8	5.4	5.4	1.0
Dinoseb	3.4	3.4	7.6	2.2	2.2	1.0
EPTC	5.9	6.2	33.0	5.6	5.3	1.1
Linuron	1.5	1.5	2.0	1.3	1.3	1.0
Metribuzin	13.3	19.1	11.1	.8	.6	1.4
Total	-	32.0	63.5	-	2.0	-
Region c/						
Chlorbromuron	1.8	2.2	3.7	2.1	1.7	1.2
Dalapon	6.3	6.3	36.3	5.8	5.8	1.0
Dinoseb	43.4	44.7	95.2	2.2	2.1	1.0
EPTC	20.3	20.6	101.1	5.0	4.9	1.0
Linuron	47.9	47.9	39.4	.8	.8	1.0
Metribuzin	70.2	79.9	45.0	.6	.6	1.1
Other	-	4.1	5.1	-	1.2	-
Total	-	205.7	325.8	-	1.6	-

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Regional total may differ from the sum for individual States because in some instances materials were included in the "other" category for State reporting.

Table 4. Fungicide use on fall potatoes in the Northeast region, 1979 a/

State and fungicide	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Per acre Treated	Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Maine						
Captafol	3.2	19.2	15.5	4.8	.8	6.0
Chlorothalonil	15.4	94.9	70.5	4.6	.7	6.2
Maneb/mancozeb c/	87.2	660.3	822.0	9.4	1.2	7.6
Metiram	10.8	69.4	95.8	8.9	1.4	6.4
Other	-	1.9	1.5	-	.8	-
Total	-	845.7	1,005.3	-	1.2	-
New York						
Captafol	10.2	68.2	63.3	6.2	.9	6.7
Chlorothalonil	9.1	56.4	46.3	5.1	.8	6.2
Copper	1.4	4.3	6.7	4.8	1.6	3.1
Maneb/mancozeb c/	28.9	204.8	298.1	10.3	1.5	7.1
Metiram	3.3	16.1	23.9	7.2	1.5	4.9
Other	-	.4	.1	-	.2	-
Total	-	350.2	438.4	-	1.3	-
Pennsylvania						
Captafol	1.2	4.0	3.6	3.0	.9	3.3
Chlorothalonil	4.6	21.0	28.9	6.3	1.4	4.6
Copper	.6	1.2	.7	1.2	.6	2.0
Maneb/mancozeb c/	17.9	135.8	215.6	12.0	1.6	7.6
Total	-	162.0	248.8	-	1.5	-
Region d/						
Captafol	26.0	91.4	82.5	3.2	.9	3.5
Chlorothalonil	29.0	172.3	145.7	5.0	.8	5.9
Copper	2.7	6.8	8.9	3.3	1.3	2.5
Maneb/mancozeb c/	134.0	1,000.9	1,335.6	10.0	1.3	7.5
Metiram	14.1	85.5	119.7	8.5	1.4	6.1
Other	-	1.0	.1	-	.1	-
Total	-	1,357.9	1,692.5	-	1.2	-

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Maneb and mancozeb are similar products; they are shown as one data entry.

d/ Regional total may differ from the sum for individual States because in some instances materials were included in the "other" category for State reporting.

late blight.

Maneb/mancozeb is the predominant fungicide in each of the three States. It has been used for a number of years, is relatively inexpensive, and more dependable than most of the other fungicides (3). It is applied to the foliage and the extent of use is influenced by weather conditions that favor disease development (6). Maneb/mancozeb is used to control late blight, a problem in the Northeast. A total of 1.3 million pounds (a.i.) of maneb/mancozeb was used, 79 percent of the total quantity of all fungicides (Table 4). More acres were treated with maneb/mancozeb than any other fungicide.

Insecticides

In terms of acre-treatments, insecticides were second in use in the Northeast region (Table 2). Of the 12 most commonly used insecticides, endosulfan was used most often, accounting for almost 100,000 acre-treatments, or 19 percent of all insecticide acre-treatments. About 80,000 pounds (a.i.) of endosulfan were used in the region. Carbofuran and aldicarb were the second and third ranked insecticides, with almost 69,000 and 62,000 acre-treatments.

In the Northeast, aldicarb is used primarily to control insects, but it also controls nematodes. It was the only chemical reported that is registered to control both.

Insect problems were more prominent in New York than in Maine or Pennsylvania. Insects have become quite a problem on Long Island, particularly the Colorado potato beetle (1). New York planted 25 percent of the potato acreage in the Northeast region and used 60 percent of this region's insecticides (Table 5).

Aldicarb application rates were higher in New York than the other two States (Table 5). This was because two special local need (SLN) registrations (24c) were issued by EPA. These SLN's permitted up to 5 pounds (a.i.) of aldicarb to be applied per acre for golden nematode control and a sidedress

application of 2 pounds (a.i.) per acre for Colorado potato beetle control. The SLN's were in addition to the 3 pounds (a.i.) per acre normally used as an in furrow treatment. The use of aldicarb on Long Island was suspended in March 1980.

Demeton and disulfoton are used more extensively in Maine than elsewhere in the region because Maine is a large producer of certified seed potatoes. Demeton and disulfoton control aphids that transmit disease virus. Certified seed potatoes must pass stringent disease tests for certification (4).

Vine Killers

Vine killers were used on 153,000 acres of potatoes or 81 percent of the total planted area (Table 1). Vine killers are used as a harvest aid. The vines are sprayed 2 weeks before harvest. The vines wither and die; the skins set and digging is facilitated and bruising reduced. Vine killers were applied 1.6 times in Maine; where the number of applications were the highest (Table 6). The range in the number of applications for the other States was from 1.0 to 1.3.

Dinoseb was by far the most commonly used vine killer; 88 percent of all vine killer acre-treatments were made with dinoseb which accounted for 95 percent of the total quantity in pounds (a.i.). Other chemicals used were ametryn, endothall, and paraquat.

Growth Regulators

Growth regulators were of minor importance in the Northeast region. Less than 8,000 acres were treated with maleic hydrazide, using 23,000 pounds (a.i.) (Table 7).

Maleic hydrazide is sprayed on the potato plant in the field and the active ingredient is translocated to the tuber, retarding sprout growth during storage.

Table 5. Insecticide use on fall potatoes in the Northeast region, 1979 a/

State and insecticide	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Per acre Treated	Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Maine						
Aldicarb	17.3	17.3	31.4	1.8	1.8	1.0
Azinphosmethyl	7.5	8.7	2.4	.3	.3	1.2
Carbaryl	10.8	15.2	12.9	1.2	.8	1.4
Carbofuran	1.3	1.3	.8	.6	.6	1.0
Demeton	23.0	35.2	13.0	.6	.4	1.5
Disulfoton	34.7	35.9	70.4	2.0	2.0	1.0
Endosulfan	7.0	14.7	10.9	1.6	.7	2.1
Methamidophos	3.8	5.8	4.3	1.1	.7	1.5
Parathion	11.5	19.2	13.3	1.2	.7	1.7
Other	-	6.4	2.3	-	.4	-
Total	-	159.7	161.7	-	1.0	-
New York						
Aldicarb	29.7	31.5	119.9	4.0	3.8	1.1
Azinphosmethyl	3.3	6.5	3.4	1.0	.5	2.0
Carbaryl	2.6	8.1	5.8	2.2	.7	3.1
Carbofuran	18.4	64.9	66.4	3.6	1.0	3.5
Disulfoton	3.3	3.3	8.9	2.7	2.7	1.0
Endosulfan	19.5	79.8	66.2	3.4	.8	4.1
Fenvalerate	10.8	23.4	4.0	.4	.2	2.2
Methamidophos	17.4	30.2	29.4	1.7	1.0	1.7
Parathion	13.8	36.0	35.7	2.6	1.0	2.6
Permethrin	4.7	18.0	3.2	.7	.2	3.8
Phorate	.8	.8	2.2	2.6	2.6	1.0
Other	-	4.2	4.3	-	1.3	-
Total	-	306.7	349.4	-	1.1	-
Pennsylvania						
Aldicarb	12.7	12.8	37.1	2.9	2.9	1.0
Azinphosmethyl	2.7	7.3	6.2	2.3	.8	2.7
Carbaryl	3.0	5.8	6.0	2.0	1.0	1.9
Carbofuran	1.5	2.4	2.1	1.4	.9	1.6
Disulfoton	2.7	3.0	9.2	3.4	3.1	1.1
Endosulfan	2.1	4.3	1.7	.8	.4	2.0
Methamidophos	3.9	4.9	4.3	1.1	.9	1.3
Permethrin	5.7	13.3	2.1	.4	.2	2.3
Phorate	3.0	3.4	8.0	2.7	2.4	1.1
Other	-	2.4	1.5	-	.6	-
Total	-	59.6	78.2	-	1.3	-

-- continued

Table 5. Insecticide use on fall potatoes in the Northeast region, 1979 a/ -- continued

State and insecticide	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Per acre Treated	Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Region c/						
Aldicarb	59.7	61.6	188.4	3.2	3.1	1.0
Azinphosmethyl	13.5	22.5	12.0	.9	.5	1.7
Carbaryl	16.4	29.1	24.7	1.5	.8	1.8
Carbofuran	21.2	68.6	69.3	3.3	1.0	3.2
Demeton	23.0	35.2	13.0	.6	.4	1.5
Disulfoton	40.7	42.2	88.5	2.2	2.1	1.0
Endosulfan	28.6	98.8	78.8	2.8	.8	3.5
Fenvalerate	11.1	24.0	4.1	.4	.2	2.2
Methamidophos	25.1	40.9	38.0	1.5	.9	1.6
Parathion	25.3	55.2	49.0	1.9	.9	2.2
Permethrin	10.4	31.3	5.3	.5	.2	3.0
Phorate	3.8	4.2	10.2	2.6	2.4	1.1
Other	-	12.4	8.0	-	.6	-
Total	-	526.0	589.3	-	1.1	-

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Regional total may differ from the sum for individual States because in some instances materials were included in the "other" category for State reporting.

Table 6. Vine killer use on fall potatoes in the Northeast region, 1979 a/

State and vine killer	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Per acre Treated	Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Maine						
Dinoseb	93.2	146.1	386.9	4.2	2.7	1.6
Endothall	8.8	10.7	8.1	.9	.8	1.2
Other	-	.6	2.2	-	3.7	-
Total	-	157.4	397.2	-	2.5	-
New York						
Ametryn	4.4	4.8	10.4	2.4	2.2	1.1
Dinoseb	25.1	26.2	100.4	4.0	3.8	1.0
Endothall	.7	.7	.8	1.1	1.1	1.0
Paraquat	6.7	6.7	4.9	.7	.7	1.0
Total	-	38.4	116.5	-	3.0	-
Pennsylvania						
Ametryn	.6	.6	2.0	3.3	3.3	1.0
Dinoseb	13.1	17.4	43.9	3.4	2.5	1.3
Paraquat	.9	1.2	1.2	1.3	1.0	1.3
Total	-	19.2	47.1	-	2.5	-
Region c/						
Ametryn	5.0	5.4	12.4	2.5	2.4	1.1
Dinoseb	131.4	189.7	531.2	4.0	2.8	1.4
Endothall	9.5	11.4	8.9	.9	.8	1.2
Paraquat	7.6	7.9	6.1	.8	.8	1.0
Other	-	.6	2.2	-	3.7	-
Total	-	215.0	560.8	-	2.6	-

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Regional total may differ from the sum for individual States because in some instances materials were included in the "other" category for State reporting.

Table 7. Growth regulator use on fall potatoes in the Northeast region, 1979 a/

State and growth regulator	Treated acres b/	Acre-treatments	Quantity applied (a.i.) Total	Quantity applied (a.i.) Per acre Treated	Quantity applied (a.i.) Per acre Treatment	Times applied
	1,000	1,000	1,000 lbs.	Lbs.	Lbs.	No.
Maine						
Maleic hydrazide	3.2	3.2	10.6	3.3	3.3	1.0
New York						
Maleic hydrazide	1.5	1.5	2.7	1.8	1.8	1.0
Pennsylvania						
Maleic hydrazide	3.0	3.0	10.1	3.4	3.4	1.0
Region						
Maleic hydrazide	-	7.7	23.4	3.0	3.0	1.0

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

It is the only chemical sprout inhibitor registered for field use. Chlorpropham (CIPC) and tecnazene are also used as growth regulators on potatoes in storage but are not reported in this survey. Tecnazene is used to retard sprouting of seed potatoes (9).

Tank-mixes

Just over 155,000 acre-treatments of pesticides were made as tank mixes, or about 6 percent of the total pesticide acre-treatments (Table 2). Of the 13 most prominent tank-mixes reported, all included a fungicide and 10 contained maneb/mancozeb. Maneb/mancozeb mixes accounted for over 60 percent of all tank-mix acre-treatments (Table 8). Land treated with a tank-mix received from 1.0 to 2.5 applications during the 1979 season. Maine reported more tank-mixes than New York or Pennsylvania.

Table 8. Pesticides applied as tank-mixes to fall potatoes in the Northeast region, 1979 a/

Pesticides	Treated acres	Acre-treatments	Total quantity applied (a.i.)	Times applied	State using b/
	1,000			No.	
Azinphosmethyl	7.0	16.1	5.0	2.3	ME, NY
+ maneb/mancozeb			16.6		
Carbaryl	3.7	5.8	5.5	1.6	ME, PA
+ maneb/mancozeb			7.1		
Chlorothalonil	.9	.9	.8	1.0	ME
+ demeton			2.8		
Chlorothalonil	1.6	1.6	1.2	1.0	ME, PA
+ dinoseb			6.0		
Demeton	17.2	24.2	9.0	1.4	ME
+ maneb/mancozeb			29.6		
Demeton	4.4	8.8	2.1	2.0	ME
+ metiram			11.8		
Dinoseb	11.5	14.4	38.6	1.3	ME, NY, PA
+ maneb/mancozeb			20.2		
Endosulfan	2.5	5.6	3.5	2.2	ME, NY
+ maneb/mancozeb			6.8		
Maneb/mancozeb	8.0	12.4	15.9	1.6	ME, NY, PA
+ methamidophos			9.1		
Maneb/mancozeb	3.1	3.1	8.0	1.0	ME, PA
+ maleic hydrazide			11.0		
Maneb/mancozeb	4.0	7.1	9.5	1.8	ME, NY
+ parathion			3.4		
Maneb/mancozeb	3.4	5.8	8.8	1.7	PA
+ permethrin			.8		
Maneb/mancozeb	1.7	4.3	6.0	2.5	NY, PA
+ phosmet			2.0		
Other c/	-	45.7	90.0		
Total	-	155.8	331.1		

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division.
b/ Maine, New York, and Pennsylvania.
c/ Includes 46 separate combinations.

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Appendix Table 1. Coefficients of variation for acres of potatoes treated with pesticides in the Northeast region, 1979 a/

Pesticide	Maine	New York	Pennsylvania	Region
	Percent			
Herbicides				
Chlorbromuron	b/	44	-	42
Dalapon	36	93	40	27
EPTC	b/	12	20	11
Linuron	12	12	44	9
Metribuzin	9	14	10	7
Fungicides				
Captafol	44	16	49	15
Chlorothalonil	19	17	23	12
Copper	b/	49	70	39
Maneb/mancozeb	7	9	10	5
Metiram	23	32	-	19
Insecticides				
Aldicarb	17	5	11	6
Azinphosmethyl	28	32	32	19
Carbaryl	23	37	30	17
Carbofuran	71	7	44	8
Demeton	15	-	-	15
Disulfoton	11	31	32	10
Endosulfan	29	6	36	9
Fenvalerate	-	13	b/	13
Methamidophos	40	11	26	11
Parathion	22	14	-	13
Permethrin	-	25	20	16
Phorate	-	61	30	27
Vine killers				
Ametryn	-	26	70	25
Dinoseb c/	3	7	10	3
Endothall	26	70	-	24
Paraquat	-	19	57	18
Growth regulator				
Maleic hydrazide	44	49	30	24

- None reported.

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division. The coefficient of variation is the standard error of the estimate divided by acres treated times 100. The coefficient indicates the relative variation of the estimate. The higher the coefficient the less reliable the estimate.

b/ Use of this material at the State level was not significant.

c/ Includes amounts used as a herbicide.

Appendix Table 2. Coefficients of variation for acres of potatoes treated with tank-mixes in the Northeast region, 1979 a/

Pesticide	Maine	New York	Pennsylvania	Region
	Percent			
Azinphosmethyl + maneb/mancozeb	71	70	-	52
Carbaryl + maneb/mancozeb	45	-	71	39
Chlorothalonil + demeton	71	-	-	71
Chlorothalonil + dinoseb	b/	-	57	53
Demeton + maneb/mancozeb	18	-	-	18
Demeton + metiram	37	-	-	37
Dinoseb + maneb/mancozeb	27	70	34	21
Endosulfan + maneb/mancozeb	58	70	-	46
Maneb/mancozeb + methamidophos	35	43	50	25
Maneb/mancozeb + maleic hydrazide	b/	-	34	34
Maneb/mancozeb + parathion	50	49	-	36
Maneb/mancozeb + permethrin	-	-	29	29
Maneb/mancozeb + phosmet	-	57	70	42

- None reported.

a/ "1979 Fall Potato Pesticide Survey," USDA, ESCS, Natural Resource Economics Division. The coefficient of variation is the standard error of the estimate divided by acres treated times 100. The coefficient indicates the relative variation of the estimate. The higher the coefficient the less reliable the estimate.

b/ Use of this material at the State level was not significant.